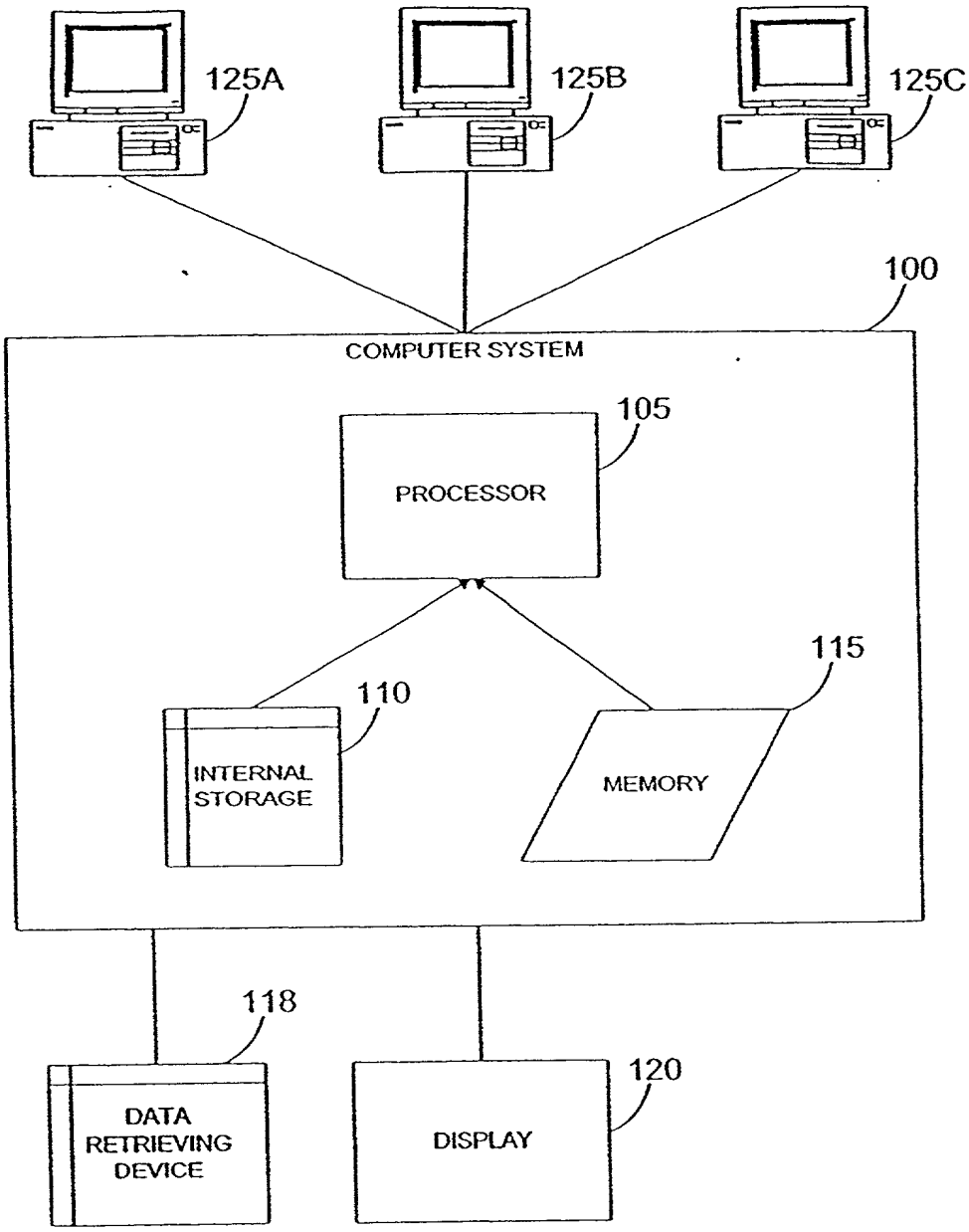
125A
125B
125C
100
COMPUTER SYSTEM
105
PROCESSOR
115
110
INTERNAL STORAGE
MEMORY
118
DATA RETRIEVING DEVICE
120
DISPLAY

FIGURE 1

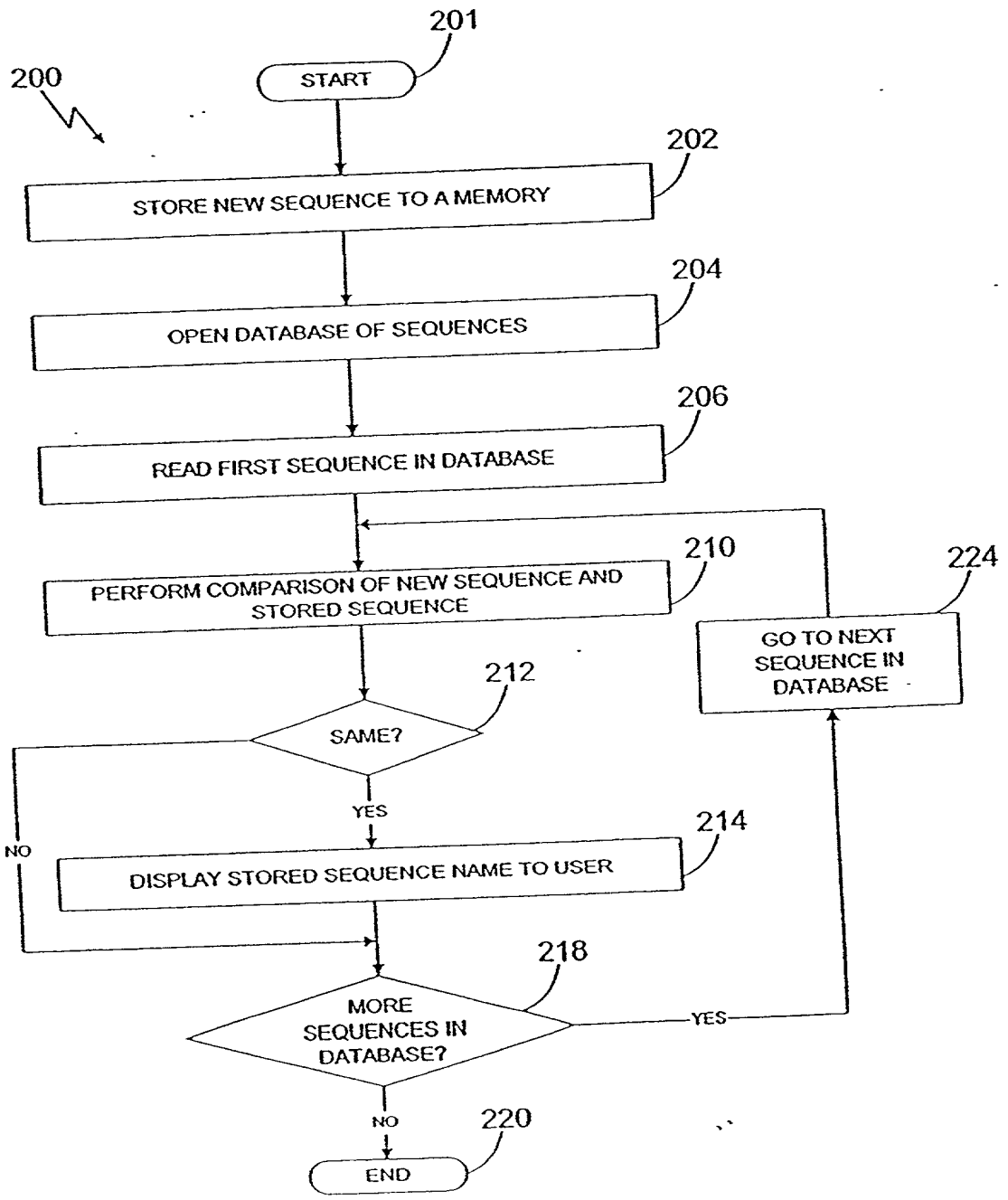
200
201
START
202
STORE NEW SEQUENCE TO A MEMORY
204
OPEN DATABASE OF SEQUENCES
206
READ FIRST SEQUENCE IN DATABASE
210
PERFORM COMPARISON OF NEW SEQUENCE AND STORED SEQUENCE
212
SAME?
YES
NO
214
DISPLAY STORED SEQUENCE NAME TO USER
218
MORE SEQUENCES IN DATABASE?
YES
NO
220
END
224
GO TO NEXT SEQUENCE IN DATABASE

FIGURE 2

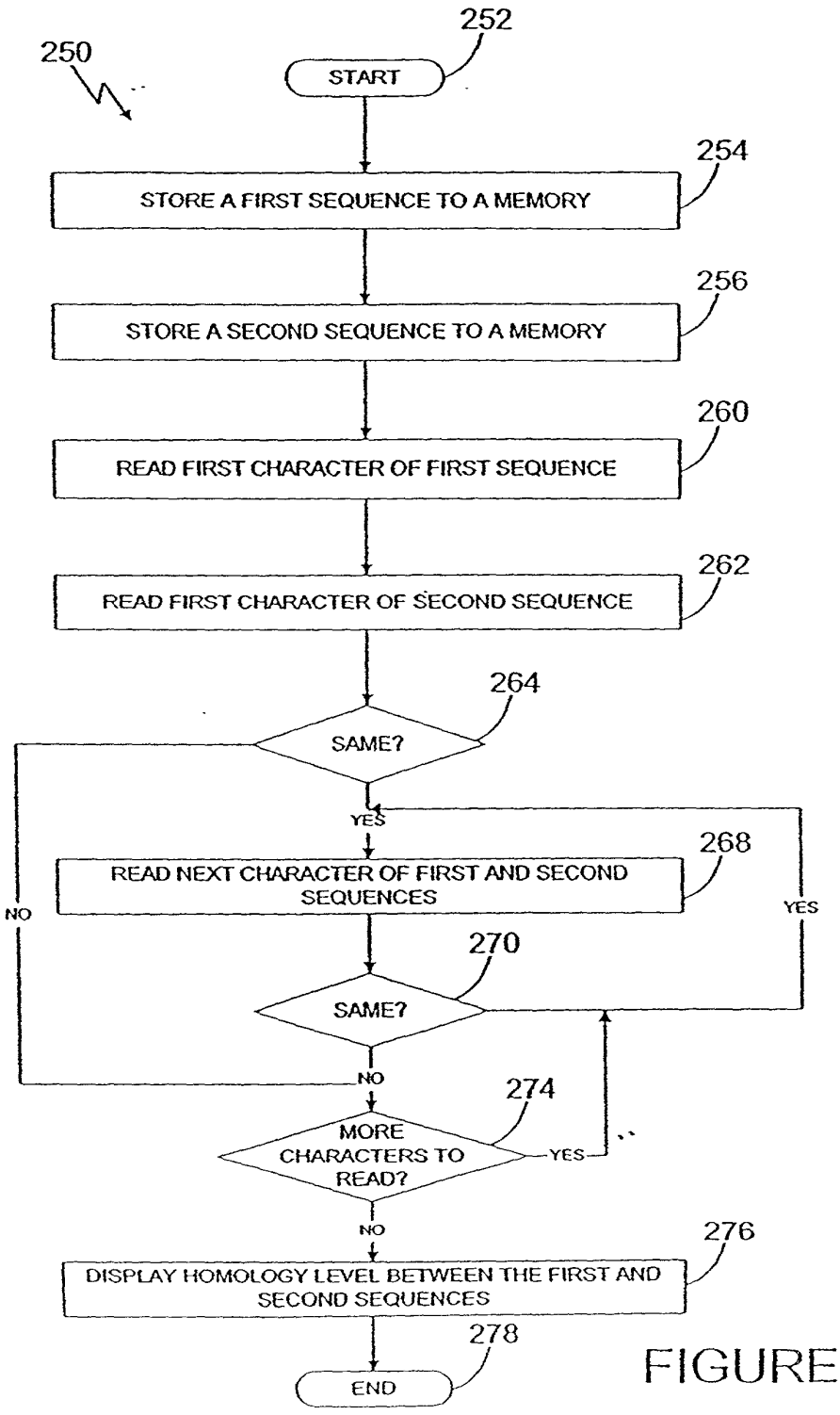
250
252
START
254
STORE A FIRST SEQUENCE TO A MEMORY
256
STORE A SECOND SEQUENCE TO A MEMORY
260
READ FIRST CHARACTER OF FIRST SEQUENCE
262
READ FIRST CHARACTER OF SECOND SEQUENCE
264
SAME?
YES
NO
268
READ NEXT CHARACTER OF FIRST AND SECOND SEQUENCES
YES
270
SAME?
NO
274
MORE CHARACTERS TO READ?
YES
NO
276
DISPLAY HOMOLOGY LEVEL BETWEEN THE FIRST AND SECOND SEQUENCES
278
END

FIGURE 3

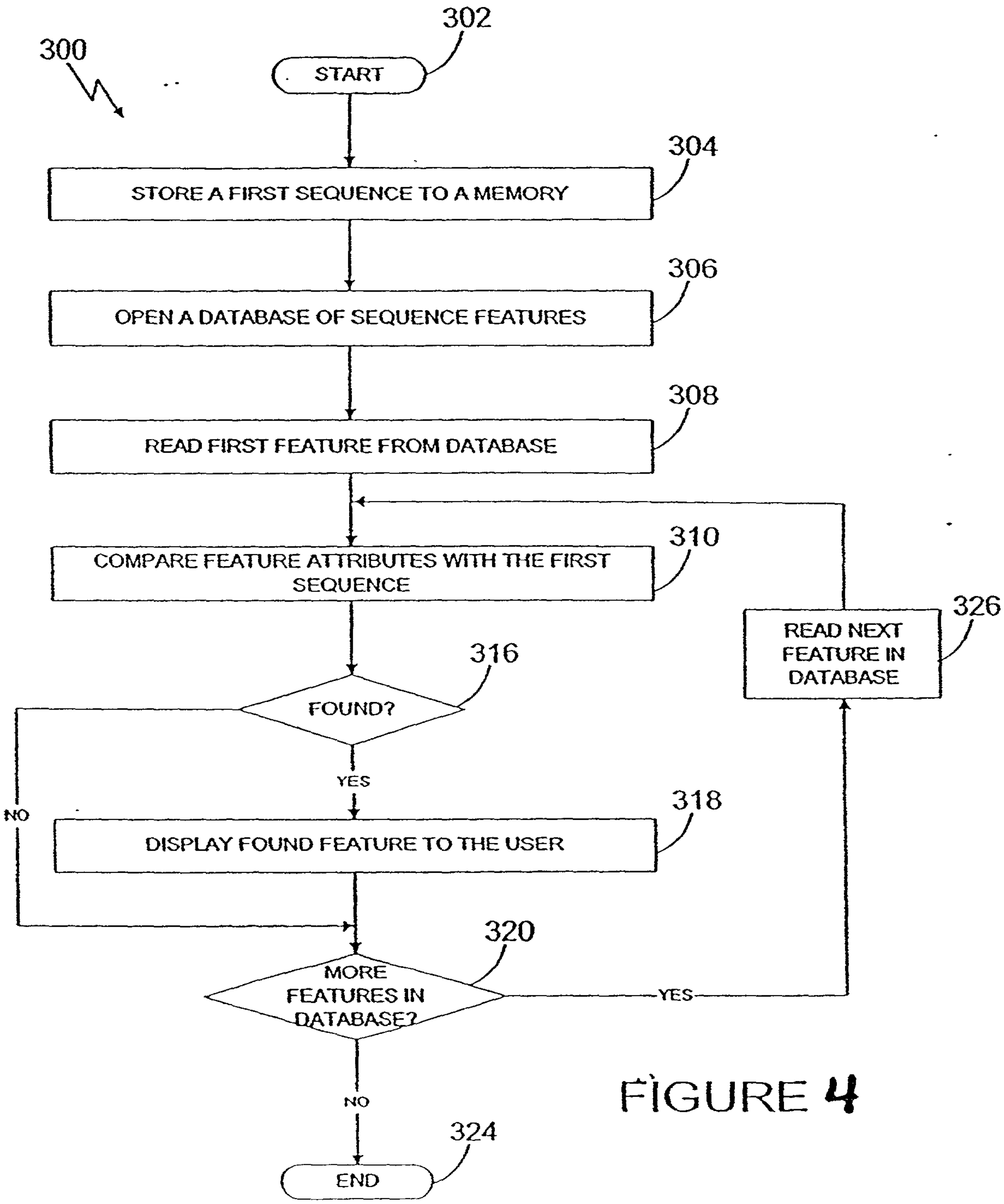

FIGURE 4

FIGURE 5A NUCLEOTIDE SEQUENCE FOR Y. PESTIS BLAST PHYTASE (SEQ ID NO:1)

ATGTCAGTATTAGAAAATCGTGTACGGCTATCTGGGCTGGTATTGATGCTAAGCGGA
TTGGCTGCTATTACTGCGCCGGTAGCCGCCGAGCCATCGGGCTATACTTTAGAACGT
GTGGTTATTTTGAGTCGCCATGGTGTTCGCTCGCCGACCAAACAAACGCAGCTTATG
AATGATGTTACGCCAGATAAGTGGCCACAATGGCCGGTAAAAGCGGGGTATTTAAC
GCCACGTGGTGCGGAGTTGGTCACATTGATGGGGGGGTTTTATGGTGATTACTTTCG
CAGCCTTGGTTTGTTAGCGGCGGGATGTCCGGCAGAGGGGGGGGTATATGCACAGG
CAGATATCGATCAACGTACCCGCTTAACCGGACAGGCATTTCTTGATGGTGTGGCTC
CGGGGTGTGGTTTGACCGTGCATAATCAGGCCGATTTGAAAAAGACCGATCCCCTGT
TCCATCCGGTAGAGGNTGGCGTGTGTAAGTTANACGNNGCACAAACAGATAAAGCG
ATTGAAGAACANTTGGGCGGGCCGTTAGATACGGTGAGCCAGCGCTACGCTAAACC
TTTTGCCCAGATGGGGGACGTGCTGAATTTTGCGGCTTCTCCTTATTGCAAATCTTTG
CAACAGCAAGGAAAAACGTGTGATTTTGCCCACTTTGCGGCCAATGAAGTTAACGTT
AATAAAGAAGGGACAAAAGTGACCCTCAGTGGGCCACTGGCGTTATCATCGACATT
GGGTGAAATCTTCTTATTACAAAACGCACAAGCCATGCCAGAGGTTGCCTGGCAAC
GGCTAAAAGGGGCGGAGAATTGGGTATCCTTATTGTCATTACATAACGCGCAATTTA
ATTTAATGGCAAAAACACCGTATATCGCCCGTCATAAAGGGACGCCATTATTACAGC
AGATAGATACGGCTTTAACCCTTCAACTGGATGCTCAGGGGCAAAAGCTACCCATTT
CAGCCCAAAACCGGGTCTTGTTCCTCGGTGGGCATGATACCAATATTGCCAATATTG
CGGGTATGCTGGGAGCCGACTGGCAGCTACCCGAGCAACCTGATAATACTCCACCA
GGTGGGGGGATTGGTTTTTGAACTATGGCAAAATCCGGATAACCACCAGCGCTACGTT
GCGGTGAAGATGTTCTACCAAACGATGGATCAGTTGCGTAATGCCGAAAAATTGGA
TCTGAAAAATAACCCAGCGGGTATTATTTCCGTTGCAGTTGCTGGTTGTGAAAATAA
CGGTGACGATAAGCTTTGCGAGCTTGATACATTCCAAAAGAAAGTGGCTAAGGTAA
TTGAACCTGCCTGCCACATCTAA

FIGURE 5B NUCLEOTIDE SEQUENCE FOR CORRECTED Y. PESTIS BLAST PHYTASE (SEQ ID NO:2)

MSVLENRVRLSGLVLMLSGLAAITAPVAAEPSGYTLERVVILSRHGVRSPTKQTQLMND
VTPDKWPQWPVKAGYLTPRGAELVTLMGGFYGDYFRSLGLLAAGCPAEGGVYAQADI
DQRTRLTGQAFLDGVAPGCGLTVHNQADLKKTDPLFHPVEXGVCKLXXAQTDKAIEEX
LGGPLDTVSQRYAKPFAQMGDVLNFAASPYCKSLQQQGKTCDFAHFAANEVNVNKEG
TKVTLSGPLALSSTLGEIFLLQNAQAMPEVAWQRLKGAENWVSLLSLHNAQFNLMAKT
PYIARHKGTPLLQQIDTALTLQLDAQGQKLPISAQNRVLFLGGHDTNIANIAGMLGADW
QLPEQPDNTPPGGGLVFELWQNPDNHQRYVAVKMFYQTMDQLRNAEKLDLKNNPAGII
SVAVAGCENNGDDKLCELDTFQKKVAKVIEPACHI

FIGURE 5C NUCLEOTIDE SEQUENCE FOR CORRECTED Y. PESTIS PHYTASE (SEQ ID NO:3)

ATGTCAGTATTAGAAAATCGTGTACGGCTATCTGGGCTGGTATTGATGCTAAGCGGA
TTGGCTGCTATTACTGCGCCGGTAGCCGCCGAGCCATCGGGCTATACTTTAGAACGT
GTGGTTATTTTGAGTCGCCATGGTGTTCGCTCGCCGACCAAACAAACGCAGCTTATG
AATGATGTTACGCCAGATAAGTGGCCACAATGGCCGGTAAAAGCGGGGTATTTAAC
GCCACGTGGTGCGGAGTTGGTCACATTGATGGGGGGGTTTTATGGTGATTACTTTCG
CAGCCTTGGTTTGTTAGCGGCGGGATGTCCGGCAGAGGGGGGGGTATATGCACAGG
CAGATATCGATCAACGTACCCGCTTAACCGGACAGGCATTTCTTGATGGTGTGGCTC
CGGGGTGTGGTTTGACCGTGCATAATCAGGCCGATTTGAAAAAGACCGATCCCCTGT
TCCATCCGGTAGAGACTGGCGTGTGTAAGTTAGACAACGCACAAACAGATAAAGCG
ATTGAAGAACGATTGGGCGGGCCGTTAGATACGGTGAGCCAGCGCTACGCTAAACC
TTTTGCCCAGATGGGGGACGTGCTGAATTTTGCGGCTTCTCCTTATTGCAAATCTTTG
CAACAGCAAGGAAAAACGTGTGATTTTGCCCACTTTGCGGCCAATGAAGTTAACGTT
AATAAAGAAGGGACAAAAGTGACCCTCAGTGGGCCACTGGCGTTATCATCGACATT
GGGTGAAATCTTCTTATTACAAAACGCACAAGCCATGCCAGAGGTTGCCTGGCAAC
GGCTAAAAGGGGCGGAGAATTGGGTATCCTTATTGTCATTACATAACGCGCAATTTA
ATTTAATGGCAAAAACACCGTATATCGCCCGTCATAAAGGGACGCCATTATTACAGC
AGATAGATACGGCTTTAACCCTTCAACTGGATGCTCAGGGGCAAAAGCTACCCATTT
CAGCCCAAAACCGGGTCTTGTTCCTCGGTGGGCATGATACCAATATTGCCAATATTG
CGGGTATGCTGGGAGCCGACTGGCAGCTACCCGAGCAACCTGATAATACTCCACCA
GGTGGGGGATTGGTTTTTGAACTATGGCAAAATCCGGATAACCACCAGCGCTACGTT
GCGGTGAAGATGTTCTACCAAACGATGGATCAGTTGCGTAATGCCGAAAAATTGGA
TCTGAAAAATAACCCAGCGGGTATTATTTCCGTTGCAGTTGCTGGTTGTGAAAATAA
CGGTGACGATAAGCTTTGCGAGCTTGATACATTCCAAAAGAAAGTGGCTAAGGTAA
TTGAACCTGCCTGCCACATCTAA

FIGURE 5D: AMINO ACID SEQUENCE FOR CORRECTED Y. PESTIS PHYTASE (SEQ ID NO:4)

Met Ser Val Leu Glu Asn Arg Val Arg Leu Ser Gly Leu Val Leu Met Leu Ser Gly Leu Ala Ala Ile Thr Ala Pro Val Ala Ala Glu Pro Ser Gly Tyr Thr Leu Glu Arg Val Val Ile Leu Ser Arg His Gly Val Arg Ser Pro Thr Lys Gln Thr Gln Leu Met Asn Asp Val Thr Pro Asp Lys Trp Pro Gln Trp Pro Val Lys Ala Gly Tyr Leu Thr Pro Arg Gly Ala Glu Leu Val Thr Leu Met Gly Gly Phe Tyr Gly Asp Tyr Phe Arg Ser Leu Gly Leu Leu Ala Ala Gly Cys Pro Ala Glu Gly Gly Val Tyr Ala Gln Ala Asp Ile Asp Gln Arg Thr Arg Leu Thr Gly Gln Ala Phe Leu Asp Gly Val Ala Pro Gly Cys Gly Leu Thr Val His Asn Gln Ala Asp Leu Lys Lys Thr Asp Pro Leu Phe His Pro Val Glu Thr Gly Val Cys Lys Leu Asp Asn Ala Gln Thr Asp Lys Ala Ile Glu Glu Arg Leu Gly Gly Pro Leu Asp Thr Val Ser Gln Arg Tyr Ala Lys Pro Phe Ala Gln Met Gly Asp Val Leu Asn Phe Ala Ala Ser Pro Tyr Cys Lys Ser Leu Gln Gln Gln Gly Lys Thr Cys Asp Phe Ala His Phe Ala Ala Asn Glu Val Asn Val Asn Lys Glu Gly Thr Lys Val Thr Leu Ser Gly Pro Leu Ala Leu Ser Ser Thr Leu Gly Glu Ile Phe Leu Leu Gln Asn Ala Gln Ala Met Pro Glu Val Ala Trp Gln Arg Leu Lys Gly Ala Glu Asn Trp Val Ser Leu Leu Ser Leu His Asn Ala Gln Phe Asn Leu Met Ala Lys Thr Pro Tyr Ile Ala Arg His Lys Gly Thr Pro Leu Leu Gln Gln Ile Asp Thr Ala Leu Thr Leu Gln Leu Asp Ala Gln Gly Gln Lys Leu Pro Ile Ser Ala Gln Asn Arg Val Leu Phe Leu Gly Gly His Asp Thr Asn Ile Ala Asn Ile Ala Gly Met Leu Gly Ala Asp Trp Gln Leu Pro Glu Gln Pro Asp Asn Thr Pro Pro Gly Gly Gly Leu Val Phe Glu Leu Trp Gln Asn Pro Asp Asn His Gln Arg Tyr Val Ala Val Lys Met Phe Tyr Gln Thr Met Asp Gln Leu Arg Asn Ala Glu Lys Leu Asp Leu Lys Asn Asn Pro Ala Gly Ile Ile Ser Val Ala Val Ala Gly Cys Glu Asn Asn Gly Asp Asp Lys

FIGURE 5E: NUCLEOTIDE SEQUENCE FOR 953-6 (SEQ ID NO: 5)

ATGATCGATAAATTTATTCCACAAGGGAGAGAGTCCGTGAAGCATAGCCTGCTTTTG
TCCGCCGCGCTGCTGGCGGGATGCGCCGCGTCCGCGCCCGGCGCCGACGCATCGCCT
GCCGCGCCGGGGTCGCTAAAGCTCGAAAAGGTCGTGATGCTGATGCGCCACGGCGT
TCGCCCGCCAACCAAGGCGGCGGTGGTGCCGCCCGGTTATTCGGCCGAAACATGGC
CCGACTGGCCGGTCGATTTCGGCCTGCTGACGCCGCACGGCGCGGCGGGGGTCAAG
CTGCTCGGCGAAAGCGACCGCCTCACTTTCGGCGGTCGCGGCCTATTCCCGGACGGT
TGTCCCGCCGCGGGCACGATCGTCCTCAAGGCAAGCTACAAGGAGCGCACGATCGC
GACCGCGCAGAACTGGGCCGCGGGGTTCATGCCCGGCTGCACGGCGGATGTCGCGC
ATCCCGCCGGTCCGGACGATGACGCGATCTTTCATGGGCTCGACGGCGGCCCCGCCT
CGTTCGACGGCAAGCGGGCATTCGATGCCGCGCTCGCCCAGGCGCCCGAGGGCGGG
CTGACCGCCGAAACCGCACGCCATCGCGGCGAACTGACCTTGCTCGCGAAAGTGCT
GAATTGTGCGCTGCCCGCCTGCCCGCTGATCGCCGAGCCGAGCCGACTGGTCGCGCA
GCCGCACGATCGCCCCGATCTCGAAGGCCCGCTCGACGTCGGATCGACCGCGAGCC
AGACGCTGGTGCTGGAATATCTGGAAGGCAAGCCGATGGCCGAGGTCGGCTGGGGC
CGCGTAAGCCGCGCCGAGATCGAGCAGTTGCTGCGCTTTCATCCGCTCAAATTCCGC
TATTCGAATCGCCCCGGCTATATCGCCGCCGCCGCCGCGGCGCCGATCGTGCGCGAA
ATCGTTGCGGCGCTCGACAGCAACAGCCCGGCGCGGCTGACCTTGCTCGCCGGGCA
CGACACGAACGTCGCCGACCTCGGCGGCTTCTTCGACCTGCACTGGCAGGTGCCGA
GCTATCCCGCCGACGAGGTTCCGCCCGGCAGCGCGTTGGGGTTCGAGCTGGTCAGC
AACGCGAAGGGCGACCGCTATGTCCGCGCCTTCTATCGCGCGCAGACGATGGACCA
GCTCCGCAACCTCGAACCGCTGGGGTCGGGTGACGCGCTGTACCGCCGCTATCTTCC
CATTCCGGGGTGCGGCCATTCGGTCGAGGCAACCGCGTGCAGCTGGAGTGATTTCGC
CCGGCTCGCCGCGCCGCGCGGGTAA

FIGURE 5F: AMINO ACID SEQUENCE FOR 953-6 (SEQ ID NO:6)

Met Ile Asp Lys Phe Ile Pro Gln Gly Arg Glu Ser Val Lys His Ser Leu Leu Leu Ser Ala Ala Leu Leu Ala Gly Cys Ala Ala Ser Ala Pro Gly Ala Asp Ala Ser Pro Ala Ala Pro Gly Ser Leu Lys Leu Glu Lys Val Val Met Leu Met Arg His Gly Val Arg Pro Pro Thr Lys Ala Ala Val Val Pro Pro Gly Tyr Ser Ala Glu Thr Trp Pro Asp Trp Pro Val Asp Phe Gly Leu Leu Thr Pro His Gly Ala Ala Gly Val Lys Leu Leu Gly Glu Ser Asp Arg Leu Thr Phe Gly Gly Arg Gly Leu Phe Pro Asp Gly Cys Pro Ala Ala Gly Thr Ile Val Leu Lys Ala Ser Tyr Lys Glu Arg Thr Ile Ala Thr Ala Gln Asn Trp Ala Ala Gly Phe Met Pro Gly Cys Thr Ala Asp Val Ala His Pro Ala Gly Pro Asp Asp Asp Ala Ile Phe His Gly Leu Asp Gly Gly Pro Ala Ser Phe Asp Gly Lys Arg Ala Phe Asp Ala Ala Leu Ala Gln Ala Pro Glu Gly Gly Leu Thr Ala Glu Thr Ala Arg His Arg Gly Glu Leu Thr Leu Leu Ala Lys Val Leu Asn Cys Ala Leu Pro Ala Cys Pro Leu Ile Ala Glu Pro Ser Arg Leu Val Ala Gln Pro His Asp Arg Pro Asp Leu Glu Gly Pro Leu Asp Val Gly Ser Thr Ala Ser Gln Thr Leu Val Leu Glu Tyr Leu Glu Gly Lys Pro Met Ala Glu Val Gly Trp Gly Arg Val Ser Arg Ala Glu Ile Glu Gln Leu Leu Arg Phe His Pro Leu Lys Phe Arg Tyr Ser Asn Arg Pro Gly Tyr Ile Ala Ala Ala Ala Ala Ala Pro Ile Val Arg Glu Ile Val Ala Ala Leu Asp Ser Asn Ser Pro Ala Arg Leu Thr Leu Leu Ala Gly His Asp Thr Asn Val Ala Asp Leu Gly Gly Phe Phe Asp Leu His Trp Gln Val Pro Ser Tyr Pro Ala Asp Glu Val Pro Pro Gly Ser Ala Leu Gly Phe Glu Leu Val Ser Asn Ala Lys Gly Asp Arg Tyr Val Arg Ala Phe Tyr Arg Ala Gln Thr Met Asp Gln Leu Arg Asn Leu Glu Pro Leu Gly Ser Gly Asp Ala Leu Tyr Arg Arg Tyr Leu Pro Ile Pro Gly Cys Gly His Ser Val Glu Ala Thr Ala Cys Ser Trp Ser Asp Phe Ala Arg Leu Ala Ala Pro Arg Gly;

FIGURE 5G: NUCLEOTIDE SEQUENCE FOR RHIZOBIUM (SEQ ID NO: 7)

GTGAAGCATAGCCTGCTTTTGCCTGCCGCGCTGCTGGCGGGATGCGCCGCGTCCGCG
CCCGGAGCCGACGCATCGCCTGCCGCGCCGGGGTCGCTAAAGCTCGAAAAGGTCGT
AATGCTGATGCGCCACGGCGTTCGCCCGCCAACCAAGGCGGCGGTGGTGCCGCCCG
GTTATTCGGCCGAAACATGGCCCGACTGGCCGGTCGATTTCGGCCTGCTGACGCCGC
ACGGCGCGGCGGGGGTCAAGCTTCTCGGCGAAAGCGACCGCCTCTATTTCGGCGGT
CGCGGCCTGTTTCCCGAGGGATGCCCGGCGGCGGGCACGATCGTCCTCAAGGCGAG
CTACAAGGAGCGCACGATCGCCACCGCGCAGAGCTGGGCCGCGGGGTTCATGCCCG
GCTGCGCGACGGATGTCGCGCATCCCGCCGGTCCGGACGATGACGCGATCTTTCATG
GGCTCGACGGCGGCCCCGCCTCGTTCGACGGCAAGCGGGCGTTCGATGCCGCGCTC
GCCCAGGCGCCCGAGGGCGGGCTGACCGCCGAAACCGCACGTCATCGCGGCGAACT
GACCTTGCTCGCGAAAGTGCTGAATTGCGCGCTGCCCGCCTGCCCGCTGATCGCCGA
GCCGAGCCGGCTGGTCGCGCAGCCGCACGATCGCCCCGAGATCGAAGGCCCGCTCG
ACGTCGGATCGACCGCCAGCCAGACGCTGGTGCTGGAATATCTGGAAGGCAAGCCG
ATGGCCGAGGTCGGCTGGGGCCGCGTGAGCCGCGCCGAGATCGAGCAGTTGCTGCG
CTTTCATCCGCTCAAATTCCGCTATTCGAATCGCCCCGGCTATATCGCCGCCACCGCC
GCGGCGCCGATCGTGCGCGAAATCGTCACGGCGCTCGGCGACCGAAGCCCGGCGCG
GCTGACCTTGCTCGCCGGGCACGACACGAACGTCGCCGACCTCGGCGGCTTCTTCGA
CCTGCACTGGCAGGTGCCGAGTTATCCCGCCGACGAGGTTCCGCCCGGCAGCGCACT
GGGGTTTGAACTGGTCAGCAATGCGAAGGGCGACCGCTATGTCCGCGCCTTCTATCG
CGGGCAGACGATGGACCAGCTCCGCAACCTCGAACCGCTGAGGTCGGACGATACGC
TGTTCCGCCGCTATCTTCCCATTCCGGGGTGCGGCAATTCGGTCGAGGCGACCGCCT
GCGCCTGGAGTGATTTCGCCCGGCTCGCCGCGCCGCGCGGGTAA

FIGURE 5H: AMINO ACID SEQUENCE FOR RHIZOBIUM (SEQ ID NO:8)

Val Lys His Ser Leu Leu Leu Pro Ala Ala Leu Leu Ala Gly Cys Ala Ala Ser Ala Pro Gly Ala Asp Ala Ser Pro Ala Ala Pro Gly Ser Leu Lys Leu Glu Lys Val Val Met Leu Met Arg His Gly Val Arg Pro Pro Thr Lys Ala Ala Val Val Pro Pro Gly Tyr Ser Ala Glu Thr Trp Pro Asp Trp Pro Val Asp Phe Gly Leu Leu Thr Pro His Gly Ala Ala Gly Val Lys Leu Leu Gly Glu Ser Asp Arg Leu Tyr Phe Gly Gly Arg Gly Leu Phe Pro Glu Gly Cys Pro Ala Ala Gly Thr Ile Val Leu Lys Ala Ser Tyr Lys Glu Arg Thr Ile Ala Thr Ala Gln Ser Trp Ala Ala Gly Phe Met Pro Gly Cys Ala Thr Asp Val Ala His Pro Ala Gly Pro Asp Asp Asp Ala Ile Phe His Gly Leu Asp Gly Gly Pro Ala Ser Phe Asp Gly Lys Arg Ala Phe Asp Ala Ala Leu Ala Gln Ala Pro Glu Gly Gly Leu Thr Ala Glu Thr Ala Arg His Arg Gly Glu Leu Thr Leu Leu Ala Lys Val Leu Asn Cys Ala Leu Pro Ala Cys Pro Leu Ile Ala Glu Pro Ser Arg Leu Val Ala Gln Pro His Asp Arg Pro Glu Ile Glu Gly Pro Leu Asp Val Gly Ser Thr Ala Ser Gln Thr Leu Val Leu Glu Tyr Leu Glu Gly Lys Pro Met Ala Glu Val Gly Trp Gly Arg Val Ser Arg Ala Glu Ile Glu Gln Leu Leu Arg Phe His Pro Leu Lys Phe Arg Tyr Ser Asn Arg Pro Gly Tyr Ile Ala Ala Thr Ala Ala Ala Pro Ile Val Arg Glu Ile Val Thr Ala Leu Gly Asp Arg Ser Pro Ala Arg Leu Thr Leu Leu Ala Gly His Asp Thr Asn Val Ala Asp Leu Gly Gly Phe Phe Asp Leu His Trp Gln Val Pro Ser Tyr Pro Ala Asp Glu Val Pro Pro Gly Ser Ala Leu Gly Phe Glu Leu Val Ser Asn Ala Lys Gly Asp Arg Tyr Val Arg Ala Phe Tyr Arg Gly Gln Thr Met Asp Gln Leu Arg Asn Leu Glu Pro Leu Arg Ser Asp Asp Thr Leu Phe Arg Arg Tyr Leu Pro Ile Pro Gly Cys Gly Asn Ser Val Glu Ala Thr Ala Cys Ala Trp Ser Asp Phe Ala Arg Leu Ala Ala Pro Arg Gly;

FIGURE 5I: NUCLEOTIDE SEQUENCE FOR 954-2 (SEQ ID NO:9)

ATGAAGAAGACGATATGGAGGAGAGTTGGACAGCGATGGCGAAGGGGTGCGTGTG
CCGCAACGGTATTGCTTTCGGCATGCTCAACGCAACTGCCGGGCGTGCCTGCAACGC
TGTCGGCCGCGGGTAGCGAGCCGCCCCGGAAGGCCGCGGCAACAGATGGCATGCCG
CAAGACTGGTCGCTCGACGCGTTGGTCATCGTCAGCCGGCACGGCGTGCGGTCTCCG
ACGCGTCCGGAGCCGCCGCTGGAGAGCCTCAGCCCCGATCCGTGGCCCCAGTGGCC
CGTGCCGACTGCCCACCTGACCGATCGTGGCGCGGCGCTCGTCTCGCAGATGGGGC
GGTACTACGGTGATTGGCTTCGTGCCCGGGGTGTGCTGCCGGCCAGCGGGTGCCCTG
CGACCGGAACGCTTTACGGATGGGCAGACGTTGACCAGCGGACCCGTCTGACGGGC
GACGCCCTGCTCCTCGGCATGGCGCCAGGCTGCGGTATCCACAGCGATCATCGCGCG
GCGCTCGACGAGAAGGATCCGATCTTCCACGCGATGGAATCGGGTGCATGCCCAGT
CGACCCCGTACAGGCGAAGCGCGACATCGAAGCGCATGCCGGCGAGGGCGGCGTG
GCGACACTGGGAAGGCGCTACGCAGCAAGCCTGACCAGAATGAGCGAGGTGCTCGA
CTACGCCCATAGCGCCGATTGCGCGAGGCATGGCGGCCAATGCGACTATGCGCGCC
AACCCAATCGTGTCGAGATCAGACCAGATGGCCTTCATGCCGCGTTGAAGGGCCCG
ATGGGCAGTGCTTCGACCGTCTCCGAGGTCTTCCTGCTCGAACATGGGCAGGGCCTG
CCACAGGAGCAGGTTGCATGGGGCCGTATCCACGATGCGCAGGACTGGACGCTGCT
GATGCAGGCGCATAACGCGCAGTTCGATCTGATGGCGAAGACGCCTTACATGGCTA
CTCGAAGGGGCACGCCGATGCTCGCTTCGGTGCTCGATGCGCTTGAGCGGCGCGCTG
GCGCCCCAGCTCCGGAGCTTGCCGTCAAAGGCCCGAAGCTGCCCCAAGGCAACCGT
GTCTATGTGCTGACCGCGCATGACACGAATCTTGCACACTTGGCCGGCTTGCTGCAC
TTGGACTGGACCCTGCCCGAGCAACCGGACGACACGCCGCCGGGCGGTGCAATGGT
GTTCTCCTTGTGGCGGGAGCCTGGCACGCAGGCACGTTTCGTTCGCGTGGAGATGGT
CTATCAGTCGATGGATCAGCTTCGGCAGCTCACGCCGCTCTCCCTGGCGCAGCCGCC
CCATCGCCTGATCTTGCCGTTGCCCGGCTGTGCCGACGCGGCGCACGGACATGCATG
CAGCCTGCCGGAGTTCAGCCGGCGTGTGCGCGCGGCATTGTCCCCCTCCTGCCTGGA
GGCTGTGACCGCGGCGCACTAG

FIGURE 5J: AMINO ACID SEQUENCE FOR 954-2 (SEQ ID NO:10)

Met Lys Lys Thr Ile Trp Arg Arg Val Gly Gln Arg Trp Arg Arg Gly Ala Cys Ala Ala Thr Val Leu Leu Ser Ala Cys Ser Thr Gln Leu Pro Gly Val Pro Ala Thr Leu Ser Ala Ala Gly Ser Glu Pro Pro Arg Lys Ala Ala Ala Thr Asp Gly Met Pro Gln Asp Trp Ser Leu Asp Ala Leu Val Ile Val Ser Arg His Gly Val Arg Ser Pro Thr Arg Pro Glu Pro Pro Leu Glu Ser Leu Ser Pro Asp Pro Trp Pro Gln Trp Pro Val Pro Thr Ala His Leu Thr Asp Arg Gly Ala Ala Leu Val Ser Gln Met Gly Arg Tyr Tyr Gly Asp Trp Leu Arg Ala Arg Gly Val Leu Pro Ala Ser Gly Cys Pro Ala Thr Gly Thr Leu Tyr Gly Trp Ala Asp Val Asp Gln Arg Thr Arg Leu Thr Gly Asp Ala Leu Leu Leu Gly Met Ala Pro Gly Cys Gly Ile His Ser Asp His Arg Ala Ala Leu Asp Glu Lys Asp Pro Ile Phe His Ala Met Glu Ser Gly Ala Cys Pro Val Asp Pro Val Gln Ala Lys Arg Asp Ile Glu Ala His Ala Gly Glu Gly Gly Val Ala Thr Leu Gly Arg Arg Tyr Ala Ala Ser Leu Thr Arg Met Ser Glu Val Leu Asp Tyr Ala His Ser Ala Asp Cys Ala Arg His Gly Gly Gln Cys Asp Tyr Ala Arg Gln Pro Asn Arg Val Glu Ile Arg Pro Asp Gly Leu His Ala Ala Leu Lys Gly Pro Met Gly Ser Ala Ser Thr Val Ser Glu Val Phe Leu Leu Glu His Gly Gln Gly Leu Pro Gln Glu Gln Val Ala Trp Gly Arg Ile His Asp Ala Gln Asp Trp Thr Leu Leu Met Gln Ala His Asn Ala Gln Phe Asp Leu Met Ala Lys Thr Pro Tyr Met Ala Thr Arg Arg Gly Thr Pro Met Leu Ala Ser Val Leu Asp Ala Leu Glu Arg Arg Ala Gly Ala Pro Ala Pro Glu Leu Ala Val Lys Gly Pro Lys Leu Pro Gln Gly Asn Arg Val Tyr Val Leu Thr Ala His Asp Thr Asn Leu Ala His Leu Ala Gly Leu Leu His Leu Asp Trp Thr Leu Pro Glu Gln Pro Asp Asp Thr Pro Pro Gly Gly Ala Met Val Phe Ser Leu Trp Arg Glu Pro Gly Thr Gln Ala Arg Phe Val Arg Val Glu Met Val Tyr Gln Ser Met Asp Gln Leu Arg Gln Leu Thr Pro Leu Ser Leu Ala Gln Pro Pro His Arg Leu Ile Leu Pro Leu Pro Gly Cys Ala Asp Ala Ala His Gly His Ala Cys Ser Leu Pro Glu Phe Ser Arg Arg Val Arg Ala Ala Leu Ser Pro Ser Cys Leu Glu Ala Val Thr Ala Ala His

FIGURE 5K: NUCLOETIDE SEQUENCE FOR THE EXPRESSED Y. PESTIS PHYTASE

ATGTCCGGACTGGAGAACCGCGTCCGCCTTTCCGGTTTAGTGTTAATGCTGTCCGGC
CTGGCTGCTATCACCGCGCCTGTGGCCGCCGAACCATCGGGGTACACCTTAGAACGT
GTAGTTATTTTGAGTCGCCATGGTGTGCGTAGCCCGACTAAGCAGACGCAGCTGATG
AATGATGTAACACCTGATAAGTGGCCTCAGTGGCCGGTTAAAGCGGGCTATTTGACT
CCTCGTGGCGCCGAACTGGTCACCCTGATGGGCGGGTTCTATGGCGATTATTTCCGC
AGTTTGGGTCTTTTGGCCGCGGGCTGCCCGGCAGAGGGCGGTGTATATGCACAGGCA
GATATCGACCAGCGCACTCGTTTAACCGGTCAGGCTTTTCTGGATGGTGTGGCGCCG
GGTTGCGGCCTGACTGTCCACAATCAGGCCGATCTTAAGAAAACCGATCCTCTGTTT
CATCCCGTTGAAACCGGCGTCTGTAAACTGGACAACGCCCAAACCGATAAGGCAAT
TGAGGAACGCCTGGGCGGCCCGTTAGACACGGTAAGCCAGCGCTATGCCAAACCGT
TTGCGCAAATGGGCGATGTCCTGAACTTCGCTGCGAGTCCGTACTGCAAGTCACTGC
AGCAGCAGGGGAAAACTTGTGACTTCGCACACTTTGCGGCCAACGAAGTTAATGTA
AACAAGGAAGGCACGAAAGTTACCCTGTCAGGCCCCCTGGCGCTGTCTAGCACGTT
GGGCGAAATCTTCTTGCTGCAGAACGCGCAGGCGATGCCCGAAGTAGCGTGGCAGC
GTTTGAAAGGCGCTGAGAACTGGGTGTCTCTTCTGAGCCTGCACAATGCACAGTTCA
ACCTGATGGCTAAAACGCCATACATTGCACGCCACAAAGGCACGCCGCTTTTACAG
CAAATCGATACCGCACTGACCCTGCAACTGGACGCCCAGGGGCAAAAACTGCCGAT
CTCGGCTCAGAACCGTGTTTTATTCCTGGGTGGCCACGACACAAATATTGCTAACAT
CGCCGGTATGCTGGGCGCAGATTGGCAGTTACCGGAACAACCGGATAACACCCCAC
CGGGCGGCGGTCTGGTCTTTGAGCTGTGGCAGAATCCGGACAATCATCAACGTTATG
TGGCCGTTAAGATGTTCTATCAGACCATGGATCAATTGCGTAACGCCGAGAAGCTGG
ATTTAAAGAACAATCCCGCCGGCATCATCAGTGTCGCTGTGGCCGGCTGCGAGAATA
ATGGTGACGATAAACTGTGCGAACTTGATACTTTTCAAAAAAAAAGTAGCGAAAGTC
ATTGAACCTGCGTGTCATATTTAA

FIGURE 5L: AMINO ACID SEQUENCE FOR THE EXPRESSED Y. PESTIS PHYTASE

MSGLENRVRLSGLVLMLSGLAAITAPVAAEPSGYTLERVVILSRHGVRSPTKQTQLMND
VTPDKWPQWPVKAGYLTPRGAELVTLMGGFYGDYFRSLGLLAAGCPAEGGVYAQADI
DQRTRLTGQAFLDGVAPGCGLTVHNQADLKKTDPLFHPVETGVCKLDNAQTDKAIEER
LGGPLDTVSQRYAKPFAQMGDVLNFAASPYCKSLQQQGKTCDFAHFAANEVNVNKEG
TKVTLSGPLALSSTLGEIFLLQNAQAMPEVAWQRLKGAENWVSLLSLHNAQFNLMAKT
PYIARHKGTPLLQQIDTALTLQLDAQGQKLPISAQNRVLFLGGHDTNIANIAGMLGADW
QLPEQPDNTPPGGGLVFELWQNPDNHQRYVAVKMFYQTMDQLRNAEKLDLKNNPAGII
SVAVAGCENNGDDKLCELDTFQKKVAKVIEPACHI

FIGURE 5A NUCLEOTIDE SEQUENCE FOR Y. PESTIS BLAST PHYTASE (SEQ ID NO:1)

FIGURE 5b NUCLEOTIDE SEQUENCE FOR CORRECTED Y. PESTIS BLAST PHYTASE (SEQ ID NO:2)

FIGURE 5C NUCLEOTIDE SEQUENCE FOR CORRECTED Y. PESTIS PHYTASE (SEQ ID NO:3)

atgtcagtattagaaaatcgtgtacggctatctgggctggtattgatgctaagcggattggctgctattactgcgccggtagccgccgagccatcgggctatactttagaacgtgtggttattttgagtcg
ccatggtgttcgctcgccgaccaaacaaacgcagcttatgaatgatgttacgccagataagtggccacaatggccggtaaaagcggggtatttaacgccacgtggtgcggagttggtcacattgatg
gggggttttatggtgattactttcgcagccttggtttgttagcggcgggatgtccggcagaggggggggtatatgcacaggcagatatcgatcaacgtacccgcttaaccggacaggcatttcttgat
ggtgtggctccggggtgtggtttgaccgtgcataatcaggccgatttgaaaaagaccgatcccctgttccatccggtagagactggcgtgtgtaagttagacaacgcacaaacagataaagcgattg
aagaacgattgggcgggccgttagatacggtgagccagcgctacgctaaacctttgcccagatgggggacgtgctgaattttgcggcttctccttattgcaaatctttgcaacagcaaggaaaaacg
tgtgattttgcccactttgcggccaatgaagttaacgttaataaagaagggacaaaagtgaccctcagtgggccactggcgttatcatcgacattgggtgaaatcttcttattacaaaacgcacaagcca
tgccagaggttgcctggcaacggctaaaaggggcggagaattgggtatccttattgtcattacataacgcgcaatttaatttaatggcaaaaacaccgtatatcgcccgtcataaagggacgccattatt
acagcagatagatacggctttaacccttcaactggatgctcaggggcaaaagctacccatttcagcccaaaaccgggtcttgttcctcggtgggcatgataccaatattgccaatattgcgggtatgct
gggagccgactggcagctacccgagcaacctgataatactccaccaggtgggggattggtttttgaactatggcaaaatccggataaccaccagcgctacgttgcggtgaagatgttctaccaaac
gatggatcagttgcgtaatgccgaaaaattggatctgaaaaataacccagcgggtattatttccgttgcagttgctggttgtgaaaataacggtgacgataagctttgcgagcttgatacattccaaaag
aaagtggctaaggtaattgaacctgcctgccacatctaa;

FIGURE 5D: AMINO ACID SEQUENCE FOR CORRECTED Y. PESTIS PHYTASE (SEQ ID NO:4)

Met Ser Val Leu Glu Asn Arg Val Arg Leu Ser Gly Leu Val Leu Met Leu Ser Gly Leu Ala Ala Ile Thr Ala Pro Val Ala Ala Glu Pro
Ser Gly Tyr Thr Leu Glu Arg Val Val Ile Leu Ser Arg His Gly Val Arg Ser Pro Thr Lys Gln Thr Gln Leu Met Asn Asp Val Thr Pro
Asp Lys Trp Pro Gln Trp Pro Val Lys Ala Gly Tyr Leu Thr Pro Arg Gly Ala Glu Leu Val Thr Leu Met Gly Gly Phe Tyr Gly Asp Tyr
Phe Arg Ser Leu Gly Leu Leu Ala Ala Gly Cys Pro Ala Glu Gly Gly Val Tyr Ala Gln Ala Asp Ile Asp Gln Arg Thr Arg Leu Thr Gly
Gln Ala Phe Leu Asp Gly Val Ala Pro Gly Cys Gly Leu Thr Val His Asn Gln Ala Asp Leu Lys Lys Thr Asp Pro Leu Phe His Pro Val
Glu Thr Gly Val Cys Lys Leu Asp Asn Ala Gln Thr Asp Lys Ala Ile Glu Glu Arg Leu Gly Gly Pro Leu Asp Thr Val Ser Gln Arg Tyr
Ala Lys Pro Phe Ala Gln Met Gly Asp Val Leu Asn Phe Ala Ala Ser Pro Tyr Cys Lys Ser Leu Gln Gln Gln Gly Lys Thr Cys Asp Phe
Ala His Phe Ala Ala Asn Glu Val Asn Val Asn Lys Glu Gly Thr Lys Val Thr Leu Ser Gly Pro Leu Ala Leu Ser Ser Thr Leu Gly Glu
Ile Phe Leu Leu Gln Asn Ala Gln Ala Met Pro Glu Val Ala Trp Gln Arg Leu Lys Gly Ala Glu Asn Trp Val Ser Leu Leu Ser Leu His
Asn Ala Gln Phe Asn Leu Met Ala Lys Thr Pro Tyr Ile Ala Arg His Lys Gly Thr Pro Leu Leu Gln Gln Ile Asp Thr Ala Leu Thr Leu
Gln Leu Asp Ala Gln Gly Gln Lys Leu Pro Ile Ser Ala Gln Asn Arg Val Leu Phe Leu Gly Gly His Asp Thr Asn Ile Ala Asn Ile Ala
Gly Met Leu Gly Ala Asp Trp Gln Leu Pro Glu Gln Pro Asp Asn Thr Pro Pro Gly Gly Gly Leu Val Phe Glu Leu Trp Gln Asn Pro

Asp Asn His Gln Arg Tyr Val Ala Val Lys Met Phe Tyr Gln Thr Met Asp Gln Leu Arg Asn Ala Glu Lys Leu Asp Leu Lys Asn Asn Pro Ala Gly Ile Ile Ser Val Ala Val Ala Gly Cys Glu Asn Asn Gly Asp Asp Lys;

FIGURE 5E: NUCLEOTIDE SEQUENCE FOR 953-6 (SEQ ID NO: 5)

atgatcgataaatttattccacaagggagagagtccgtgaagcatagcctgcttttgtccgccgcgctgctggcgggatgcgccgcgtccgcgcccggcgccgacgcatcgcctgccgcgccgggg
gtcgctaaagctcgaaaaggtcgtgatgctgatgcgccacggcgttcgcccgccaaccaaggcggcggtggtgccgcccggttattcggccgaaacatggcccgactggccggtcgatttcggc
ctgctgacgccgcacggcgcggcgggggtcaagctgctcggcgaaagcgaccgcctcactttcggcggtcgcggcctattcccggacggttgtcccgccgcgggcacgatcgtcctcaaggca
agctacaaggagcgcacgatcgcgaccgcgcagaactgggccgcggggttcatgcccggctgcacggcggatgtcgcgcatcccgccggtccggacgatgacgcgatctttcatgggctcga
cggcggccccgcctcgttcgacggcaagcgggcattcgatgccgcgctcgcccaggcgcccgagggcgggctgaccgccgaaaccgcacgccatcgcggcgaactgaccttgctcgcgaaa
gtgctgaattgtgcgctgcccgcctgcccgctgatcgccgagccgagccgactggtcgcgcagccgcacgatcgccccgatctcgaaggcccgctcgacgtcggatcgaccgcgagccagac
gctggtgctggaatatctggaaggcaagccgatggccgaggtcggctggggccgcgtaagccgcgccgagatcgagcagttgctgcgctttcatccgctcaaattccgctattcgaatcgccccg
gctatatcgccgccgccgccgcggcgccgatcgtgcgcgaaatcgttgcggcgctcgacagcaacagcccggcgcggctgaccttgctcgccgggcacgacacgaacgtcgccgacctcggc
ggcttcttcgacctgcactggcaggtgccgagctatcccgccgacgaggttccgcccggcagcgcgttggggttcgagctggtcagcaacgcgaagggcgaccgctatgtccgcgccttctatcg
cgcgcagacgatggaccagctccgcaacctcgaaccgctggggtcgggtgacgcgctgtaccgccgctatcttcccattccggggtgcggccattcggtcgaggcaaccgcgtgcagctggagt
gatttcgcccggctcgccgcgccgcgcgggtaa;

FIGURE 5F: AMINO ACID SEQUENCE FOR 953-6 (SEQ ID NO:6)

Met Ile Asp Lys Phe Ile Pro Gln Gly Arg Glu Ser Val Lys His Ser Leu Leu Leu Ser Ala Ala Leu Leu Ala Gly Cys Ala Ala Ser Ala Pro Gly Ala Asp Ala Ser Pro Ala Ala Pro Gly Ser Leu Lys Leu Glu Lys Val Val Met Leu Met Arg His Gly Val Arg Pro Pro Thr Lys Ala Ala Val Val Pro Pro Gly Tyr Ser Ala Glu Thr Trp Pro Asp Trp Pro Val Asp Phe Gly Leu Leu Thr Pro His Gly Ala Ala Gly Val Lys Leu Leu Gly Glu Ser Asp Arg Leu Thr Phe Gly Gly Arg Gly Leu Phe Pro Asp Gly Cys Pro Ala Ala Gly Thr Ile Val Leu Lys Ala Ser Tyr Lys Glu Arg Thr Ile Ala Thr Ala Gln Asn Trp Ala Ala Gly Phe Met Pro Gly Cys Thr Ala Asp Val Ala His Pro Ala Gly Pro Asp Asp Asp Ala Ile Phe His Gly Leu Asp Gly Gly Pro Ala Ser Phe Asp Gly Lys Arg Ala Phe Asp Ala Ala Leu Ala Gln Ala Pro Glu Gly Gly Leu Thr Ala Glu Thr Ala Arg His Arg Gly Glu Leu Thr Leu Leu Ala Lys Val Leu Asn Cys Ala Leu Pro Ala Cys Pro Leu Ile Ala Glu Pro Ser Arg Leu Val Ala Gln Pro His Asp Arg Pro Asp Leu Glu Gly Pro Leu Asp Val Gly Ser Thr Ala Ser Gln Thr Leu Val Leu Glu Tyr Leu Glu Gly Lys Pro Met Ala Glu Val Gly Trp Gly Arg Val Ser Arg Ala Glu Ile Glu Gln Leu Leu Arg Phe His Pro Leu Lys Phe Arg Tyr Ser Asn Arg Pro Gly Tyr Ile Ala Ala Ala Ala Ala Ala Pro Ile Val Arg Glu Ile Val Ala Ala Leu Asp Ser Asn Ser Pro Ala Arg Leu Thr Leu Leu Ala Gly His Asp Thr Asn Val Ala Asp Leu Gly Gly Phe Phe Asp Leu His Trp Gln Val Pro Ser Tyr Pro Ala Asp Glu Val Pro Pro Gly Ser Ala Leu Gly Phe Glu Leu Val Ser Asn Ala Lys Gly Asp Arg Tyr Val Arg Ala Phe Tyr Arg Ala Gln Thr Met Asp Gln Leu Arg Asn Leu Glu Pro Leu Gly Ser Gly Asp Ala Leu Tyr Arg Arg Tyr Leu Pro Ile Pro Gly Cys Gly His Ser Val Glu Ala Thr Ala Cys Ser Trp Ser Asp Phe Ala Arg Leu Ala Ala Pro Arg Gly;

FIGURE 5G: NUCLEOTIDE SEQUENCE FOR RHIZOBIUM (SEQ ID NO: 7)

gtgaagcatagcctgcttttgcctgccgcgctgctggcgggatgcgccgcgtccgcgcccggagccgacgcatcgcctgccgcgccggggtcgctaaagctcgaaaaggtcgtaatgctgatgc
gccacggcgttcgcccgccaaccaaggcggcggtggtgccgcccggttattcggccgaaacatggcccgactggccggtcgatttcggcctgctgacgccgcacggcgcggcgggggtcaag
cttctcggcgaaagcgaccgcctctatttcggcggtcgcggcctgtttcccgagggatgcccggcggcgggcacgatcgtcctcaaggcgagctacaaggagcgcacgatcgccaccgcgcag
agctgggccgcggggttcatgcccggctgcgcgacggatgtcgcgcatcccgccggtccggacgatgacgcgatctttcatgggctcgacggcggccccgcctcgttcgacggcaagcgggc
gttcgatgccgcgctcgcccaggcgcccgagggcgggctgaccgccgaaaccgcacgtcatcgcggcgaactgaccttgctcgcgaaagtgctgaattgcgcgctgcccgcctgcccgctgat
cgccgagccgagccggctggtcgcgcagccgcacgatcgccccgagatcgaaggcccgctcgacgtcggatcgaccgccagccagacgctggtgctggaatatctggaaggcaagccgatg
gccgaggtcggctggggccgcgtgagccgcgccgagatcgagcagttgctgcgctttcatccgctcaaattccgctattcgaatcgccccggctatatcgccgccaccgccgcggcgccgatcgt
gcgcgaaatcgtcacggcgctcggcgaccgaagcccggcgcggctgaccttgctcgccgggcacgacacgaacgtcgccgacctcggcggcttcttcgacctgcactggcaggtgccgagtta
tcccgccgacgaggttccgcccggcagcgcactggggtttgaactggtcagcaatgcgaagggcgaccgctatgtccgcgccttctatcgcgggcagacgatggaccagctccgcaacctcgaa
ccgctgaggtcggacgatacgctgttccgccgctatcttcccattccggggtgcggcaattcggtcgaggcgaccgcctgcgcctggagtgatttcgcccggctcgccgcgccgcgcgggtaa;

FIGURE 5H: AMINO ACID SEQUENCE FOR RHIZOBIUM (SEQ ID NO:8)

Val Lys His Ser Leu Leu Leu Pro Ala Ala Leu Leu Ala Gly Cys Ala Ala Ser Ala Pro Gly Ala Asp Ala Ser Pro Ala Ala Pro Gly Ser
Leu Lys Leu Glu Lys Val Val Met Leu Met Arg His Gly Val Arg Pro Pro Thr Lys Ala Ala Val Val Pro Pro Gly Tyr Ser Ala Glu Thr
Trp Pro Asp Trp Pro Val Asp Phe Gly Leu Leu Thr Pro His Gly Ala Ala Gly Val Lys Leu Leu Gly Glu Ser Asp Arg Leu Tyr Phe Gly
Gly Arg Gly Leu Phe Pro Glu Gly Cys Pro Ala Ala Gly Thr Ile Val Leu Lys Ala Ser Tyr Lys Glu Arg Thr Ile Ala Thr Ala Gln Ser Trp
Ala Ala Gly Phe Met Pro Gly Cys Ala Thr Asp Val Ala His Pro Ala Gly Pro Asp Asp Asp Ala Ile Phe His Gly Leu Asp Gly Gly Pro
Ala Ser Phe Asp Gly Lys Arg Ala Phe Asp Ala Ala Leu Ala Gln Ala Pro Glu Gly Gly Leu Thr Ala Glu Thr Ala Arg His Arg Gly Glu
Leu Thr Leu Leu Ala Lys Val Leu Asn Cys Ala Leu Pro Ala Cys Pro Leu Ile Ala Glu Pro Ser Arg Leu Val Ala Gln Pro His Asp Arg
Pro Glu Ile Glu Gly Pro Leu Asp Val Gly Ser Thr Ala Ser Gln Thr Leu Val Leu Glu Tyr Leu Glu Gly Lys Pro Met Ala Glu Val Gly
Trp Gly Arg Val Ser Arg Ala Glu Ile Glu Gln Leu Leu Arg Phe His Pro Leu Lys Phe Arg Tyr Ser Asn Arg Pro Gly Tyr Ile Ala Ala
Thr Ala Ala Ala Pro Ile Val Arg Glu Ile Val Thr Ala Leu Gly Asp Arg Ser Pro Ala Arg Leu Thr Leu Leu Ala Gly His Asp Thr Asn
Val Ala Asp Leu Gly Gly Phe Phe Asp Leu His Trp Gln Val Pro Ser Tyr Pro Ala Asp Glu Val Pro Pro Gly Ser Ala Leu Gly Phe Glu
Leu Val Ser Asn Ala Lys Gly Asp Arg Tyr Val Arg Ala Phe Tyr Arg Gly Gln Thr Met Asp Gln Leu Arg Asn Leu Glu Pro Leu Arg
Ser Asp Asp Thr Leu Phe Arg Arg Tyr Leu Pro Ile Pro Gly Cys Gly Asn Ser Val Glu Ala Thr Ala Cys Ala Trp Ser Asp Phe Ala Arg
Leu Ala Ala Pro Arg Gly;

FIGURE 5I: NUCLEOTIDE SEQUENCE FOR 954-2 (SEQ ID NO:9)

atgaagaagacgatatggaggagagttggacagcgatggcgaaggggtgcgtgtgccgcaacggtattgctttcggcatgctcaacgcaactgccgggcgtgcctgcaacgctgtcggccgcg
ggtagcgagccgccccggaaggccgcggcaacagatggcatgccgcaagactggtcgctcgacgcgttggtcatcgtcagccggcacggcgtgcggtctccgacgcgtccggagccgccgc
tggagagcctcagccccgatccgtggccccagtggcccgtgccgactgcccacctgaccgatcgtggcgcggcgctcgtctcgcagatggggcggtactacggtgattggcttcgtgcccgggg
tgtgctgccggccagcgggtgccctgcgaccggaacgctttacggatgggcagacgttgaccagcggacccgtctgacgggcgacgccctgctcctcggcatggcgccaggctgcggtatcca
cagcgatcatcgcgcggcgctcgacgagaaggatccgatcttccacgcgatggaatcgggtgcatgcccagtcgaccccgtacaggcgaagcgcgacatcgaagcgcatgccggcgagggc
ggcgtggcgacactgggaaggcgctacgcagcaagcctgaccagaatgagcgaggtgctcgactacgcccatagcgccgattgcgcgaggcatggcggccaatgcgactatgcgcgccaac
ccaatcgtgtcgagatcagaccagatggccttcatgccgcgttgaagggcccgatgggcagtgcttcgaccgtctccgaggtcttcctgctcgaacatgggcagggcctgccacaggagcaggtt
gcatggggccgtatccacgatgcgcaggactggacgctgctgatgcaggcgcataacgcgcagttcgatctgatggcgaagacgccttacatggctactcgaaggggcacgccgatgctcgcttc
ggtgctcgatgcgcttgagcggcgcgctggcgccccagctccggagcttgccgtcaaaggcccgaagctgccccaaggcaaccgtgtctatgtgctgaccgcgcatgacacgaatcttgcacact
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gatggtctatcagtcgatggatcagcttcggcagctcacgccgctctccctggcgcagccgccccatcgcctgatcttgccgttgcccggctgtgccgacgcggcgcacggacatgcatgcagcct
gccggagttcagccggcgtgtgcgcgcggcattgtccccctcctgcctggaggctgtgaccgcggcgcactag;

FIGURE 5J: AMINO ACID SEQUENCE FOR 954-2 (SEQ ID NO:10)
Met Lys Lys Thr Ile Trp Arg Arg Val Gly Gln Arg Trp Arg Arg Gly Ala Cys Ala Ala Thr Val Leu Leu Ser Ala Cys Ser Thr Gln Leu
Pro Gly Val Pro Ala Thr Leu Ser Ala Ala Gly Ser Glu Pro Pro Arg Lys Ala Ala Ala Thr Asp Gly Met Pro Gln Asp Trp Ser Leu Asp
Ala Leu Val Ile Val Ser Arg His Gly Val Arg Ser Pro Thr Arg Pro Glu Pro Pro Leu Glu Ser Leu Ser Pro Asp Pro Trp Pro Gln Trp Pro
Val Pro Thr Ala His Leu Thr Asp Arg Gly Ala Ala Leu Val Ser Gln Met Gly Arg Tyr Tyr Gly Asp Trp Leu Arg Ala Arg Gly Val Leu
Pro Ala Ser Gly Cys Pro Ala Thr Gly Thr Leu Tyr Gly Trp Ala Asp Val Asp Gln Arg Thr Arg Leu Thr Gly Asp Ala Leu Leu Leu Gly
Met Ala Pro Gly Cys Gly Ile His Ser Asp His Arg Ala Ala Leu Asp Glu Lys Asp Pro Ile Phe His Ala Met Glu Ser Gly Ala Cys Pro
Val Asp Pro Val Gln Ala Lys Arg Asp Ile Glu Ala His Ala Gly Glu Gly Gly Val Ala Thr Leu Gly Arg Arg Tyr Ala Ala Ser Leu Thr
Arg Met Ser Glu Val Leu Asp Tyr Ala His Ser Ala Asp Cys Ala Arg His Gly Gly Gln Cys Asp Tyr Ala Arg Gln Pro Asn Arg Val Glu
Ile Arg Pro Asp Gly Leu His Ala Ala Leu Lys Gly Pro Met Gly Ser Ala Ser Thr Val Ser Glu Val Phe Leu Leu Glu His Gly Gln Gly
Leu Pro Gln Glu Gln Val Ala Trp Gly Arg Ile His Asp Ala Gln Asp Trp Thr Leu Leu Met Gln Ala His Asn Ala Gln Phe Asp Leu Met
Ala Lys Thr Pro Tyr Met Ala Thr Arg Arg Gly Thr Pro Met Leu Ala Ser Val Leu Asp Ala Leu Glu Arg Arg Ala Gly Ala Pro Ala Pro
Glu Leu Ala Val Lys Gly Pro Lys Leu Pro Gln Gly Asn Arg Val Tyr Val Leu Thr Ala His Asp Thr Asn Leu Ala His Leu Ala Gly Leu
Leu His Leu Asp Trp Thr Leu Pro Glu Gln Pro Asp Asp Thr Pro Pro Gly Gly Ala Met Val Phe Ser Leu Trp Arg Glu Pro Gly Thr Gln
Ala Arg Phe Val Arg Val Glu Met Val Tyr Gln Ser Met Asp Gln Leu Arg Gln Leu Thr Pro Leu Ser Leu Ala Gln Pro Pro His Arg Leu
Ile Leu Pro Leu Pro Gly Cys Ala Asp Ala Ala His Gly His Ala Cys Ser Leu Pro Glu Phe Ser Arg Arg Val Arg Ala Ala Leu Ser Pro
Ser Cys Leu Glu Ala Val Thr Ala Ala His;

FIGURE 5K: NUCLOETIDE SEQUENCE FOR THE EXPRESSED Y. PESTIS PHYTASE

ATGTCCGGACTGGAGAACCGCGTCCGCCTTTCCGGTTTAGTGTTAATGCTGTCCGGCCTGGCTGCTATCACCGCGCCTGT
GGCCGCCGAACCATCGGGGTACACCTTAGAACGTGTAGTTATTTTGAGTCGCCATGGTGTGCGTAGCCCGACTAAGCAG
ACGCAGCTGATGAATGATGTAACACCTGATAAGTGGCCTCAGTGGCCGGTTAAAGCGGGCTATTTGACTCCTCGTGGCG
CCGAACTGGTCACCCTGATGGGCGGGTTCTATGGCGATTATTTCCGCAGTTTGGGTCTTTTGGCCGCGGGCTGCCCGGC
AGAGGGCGGTGTATATGCACAGGCAGATATCGACCAGCGCACTCGTTTAACCGGTCAGGCTTTTCTGGATGGTGTGGCG
CCGGGTTGCGGCCTGACTGTCCACAATCAGGCCGATCTTAAGAAAACCGATCCTCTGTTTCATCCCGTTGAAACCGGCG
TCTGTAAACTGGACAACGCCCAAACCGATAAGGCAATTGAGGAACGCCTGGGCGGCCCGTTAGACACGGTAAGCCAGC
GCTATGCCAAACCGTTTGCGCAAATGGGCGATGTCCTGAACTTCGCTGCGAGTCCGTACTGCAAGTCACTGCAGCAGCA
GGGGAAAACTTGTGACTTCGCACACTTTGCGGCCAACGAAGTTAATGTAAACAAGGAAGGCACGAAAGTTACCCTGTC
AGGCCCCCTGGCGCTGTCTAGCACGTTGGGCGAAATCTTCTTGCTGCAGAACGCGCAGGCGATGCCCGAAGTAGCGTG
GCAGCGTTTGAAAGGCGCTGAGAACTGGGTGTCTCTTCTGAGCCTGCACAATGCACAGTTCAACCTGATGGCTAAAACG
CCATACATTGCACGCCACAAAGGCACGCCGCTTTTACAGCAAATCGATACCGCACTGACCCTGCAACTGGACGCCCAG
GGGCAAAAACTGCCGATCTCGGCTCAGAACCGTGTTTTATTCCTGGGTGGCCACGACACAAATATTGCTAACATCGCCG
GTATGCTGGGCGCAGATTGGCAGTTACCGGAACAACCGGATAACACCCCACCGGGCGGCGGTCTGGTCTTTGAGCTGT
GGCAGAATCCGGACAATCATCAACGTTATGTGGCCGTTAAGATGTTCTATCAGACCATGGATCAATTGCGTAACGCCGA
GAAGCTGGATTTAAAGAACAATCCCGCCGGCATCATCAGTGTCGCTGTGGCCGGCTGCGAGAATAATGGTGACGATAA
ACTGTGCGAACTTGATACTTTTCAAAAAAAAGTAGCGAAAGTCATTGAACCTGCGTGTCATATTTAA

FIGURE 5L: AMINO ACID SEQUENCE FOR THE EXPRESSED Y. PESTIS PHYTASE
MSGLENRVRLSGLVLMLSGLAAITAPVAAEPSGYTLERVVILSRHGVRSPTKQTQLMNDV
TPDKWPQWPVKAGYLTPRGAELVTLMGGFYGDYFRSLGLLAAGCPAEGGVYAQADIDQRT
RLTGQAFLDGVAPGCGLTVHNQADLKKTDPLFHPVETGVCKLDNAQTDKAIEERLGGPLD
TVSQRYAKPFAQMGDVLNFAASPYCKSLQQQGKTCDFAHFAANEVNVNKEGTKVTLSGPL
ALSSTLGEIFLLQNAQAMPEVAWQRLKGAENWVSLLSLHNAQFNLMAKTPYIARHKGTPL
LQQIDTALTLQLDAQGQKLPISAQNRVLFLGGHDTNIANIAGMLGADWQLPEQPDNTPPG
GGLVFELWQNPDNHQRYVAVKMFYQTMDQLRNAEKLDLKNNPAGIISVAVAGCENNGDDK
LCELDTFQKKVAKVIEPACHI

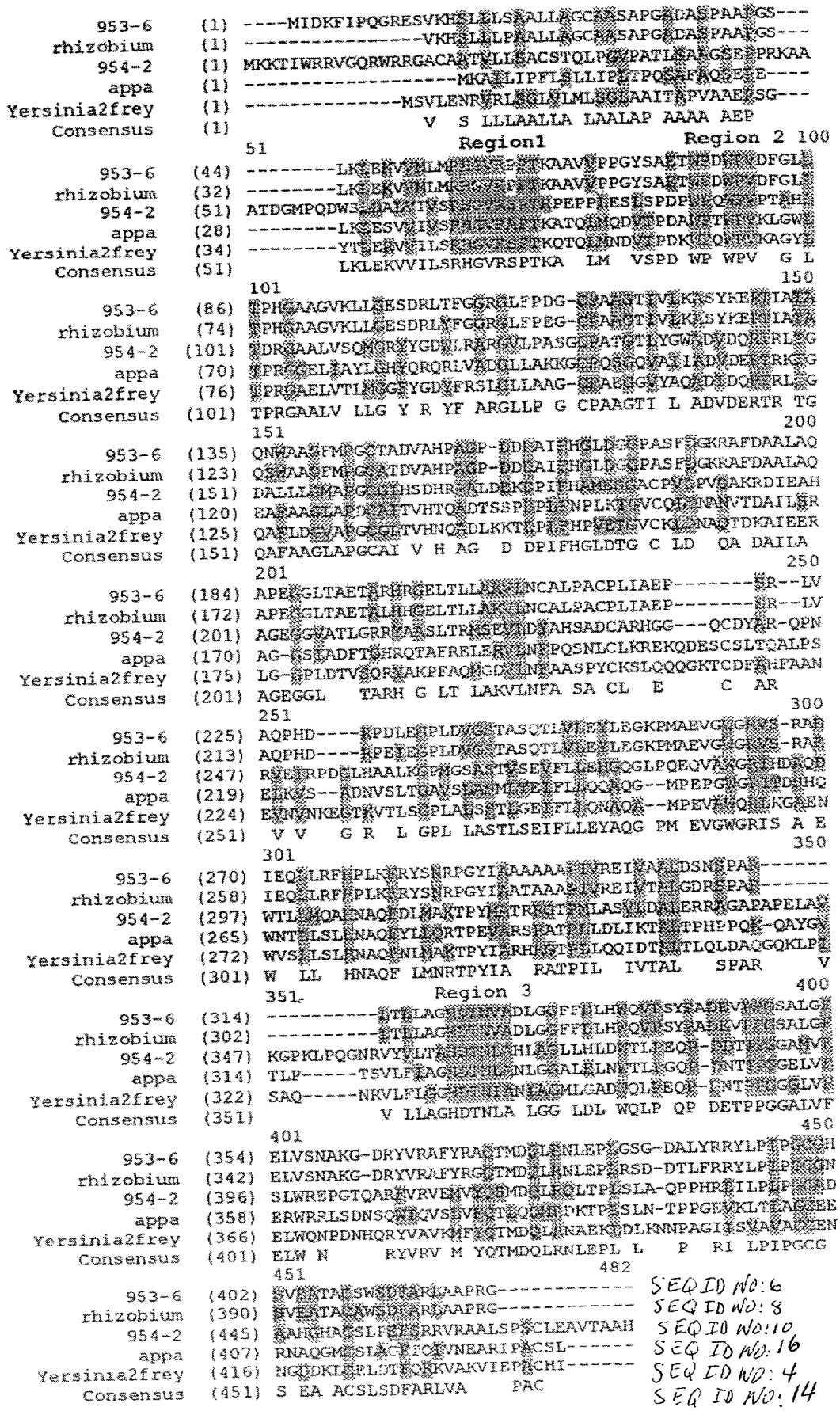

953-6
rhizobium
954-2
appa
Yersinia2frey
Consensus
Region1
Region 2
Region 3
SEQ ID NO: 6
SEQ ID NO: 8
SEQ ID NO: 10
SEQ ID NO: 16
SEQ ID NO: 4
SEQ ID NO: 14

FIGURE 6

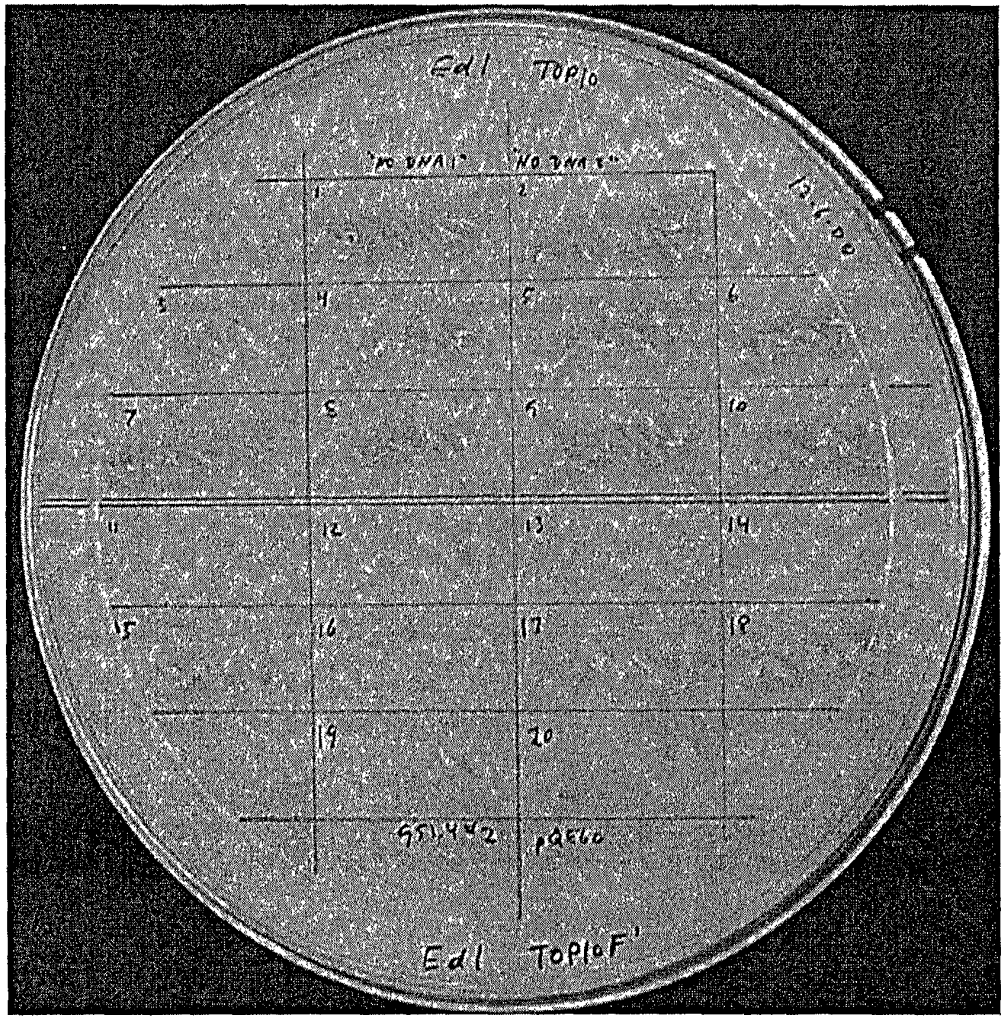


Figure 7A: Results of overlaying isolates from the re-transformation of SEQ ID NO:11 phytase plasmid DNA.

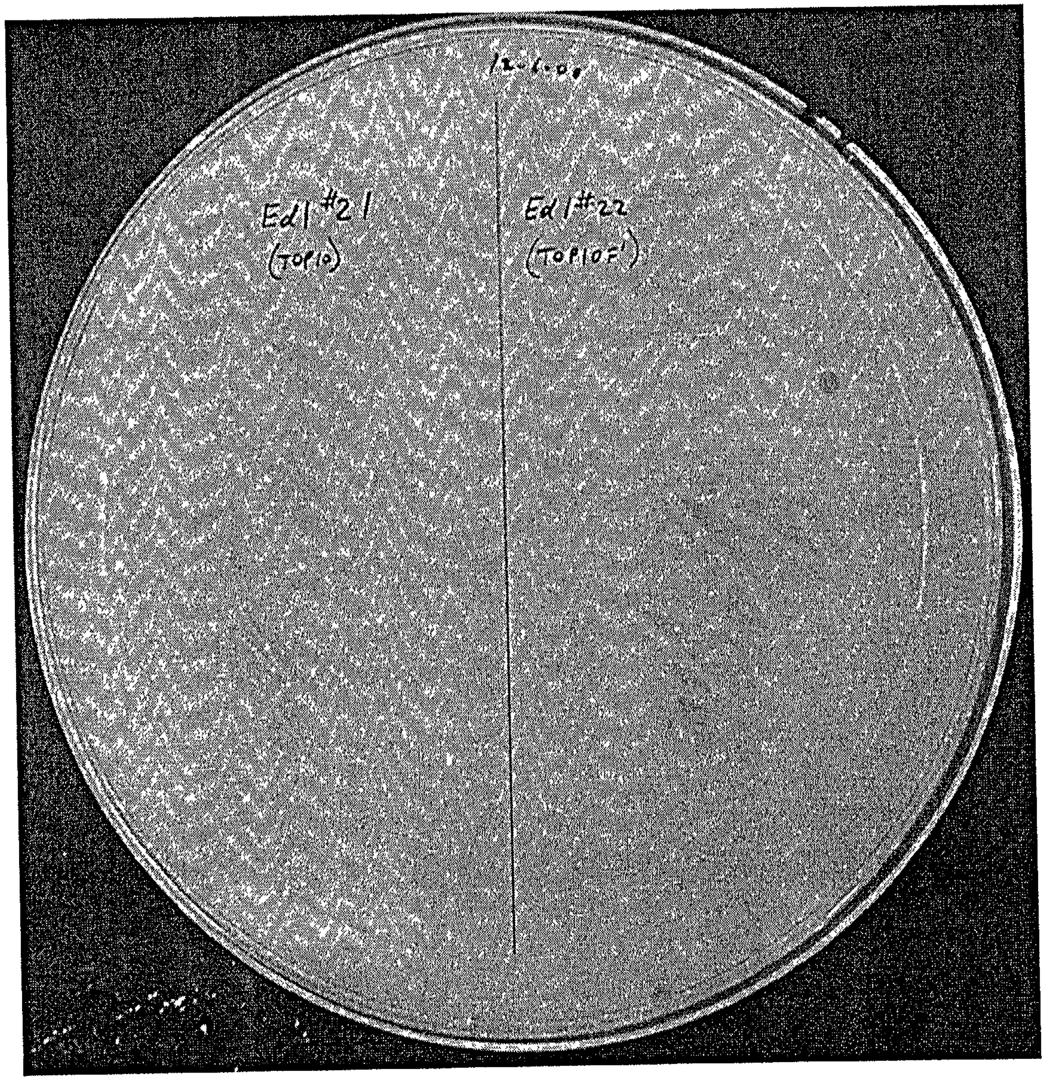


Figure 7B: Results of overlaying streaks of Ed1#21, a control isolate lacking a lot of phytase activity, and Ed1#22 OL (SEQ ID NO:11), an isolate displaying phytase activity.

Figure 8

- $T_{1/2}$ of Phytase in Pepsin Digestion

Host	T ½ (min)
E. Coli	~8
Pichia	~10
S. Cerevisae	~25

Figure 9

QSEPELKLES VVIVSRHGVR APTKATQLMQ DV**T**PDAWP**T**W PVKLGELTPR GGELIAYLGH

YWRQRLVADG LLPKCGCPQS GQVAIIADVD ERTRKTGEAF AAGLAPDCAI TVH**T**QAD**T**S**S**

PDPLFNPLKT GVCQLDNA**N**V TDAILERAGG SIADFTGHYQ TAFRELERVL NFPQSNLCLK

REKQDESCSL TQALPSELKV SADCVSLTGA VSLASMLTEI FLLQQAQGMP EPGWGRITDS

HQWNTLLSLH NAQFDLLQRT PEVARSRATP LLDLIK**T**ALT PHPPQKQAYG VTLPTSVLFI

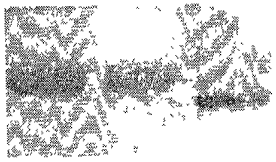
AGHDTNLANL GGALEL**N**WTL PGQPDNTPPG GELVFERWRR LSDNSQWIQV SLVFQTLQQM

RDKTPLSLNT PPGEVKLTLA GCEERNAQGM CSLAGFTQIV NEARIPACSL

Figure 10

Pichia

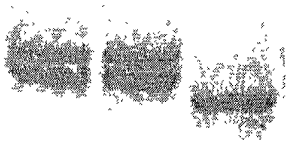
1 2 3



- Without treatment
- O-glycosidase
- Endo H

S. Cerevisae

4 5 6



4. Without treatment
5. O-glycosidase
6. Endo H

Figure 11

	Pichia	S. Cerevisiae
O-glycosilation	no	no
N-glycosilation	yes	yes
N-glycosilated form	1 dominates	2

Figure 12A

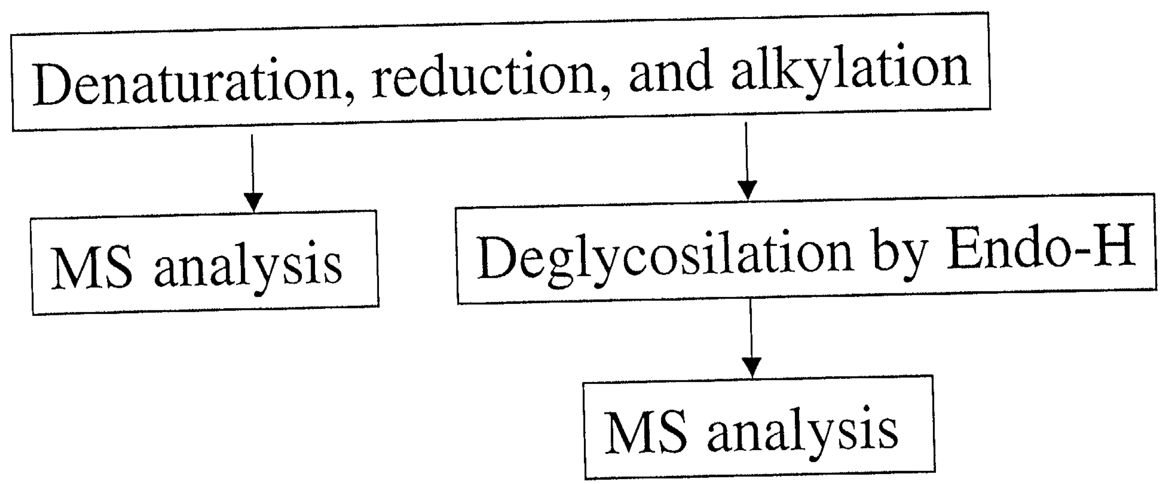

Denaturation, reduction, and alkylation
MS analysis
Deglycosilation by Endo-H
MS analysis

Figure 12B

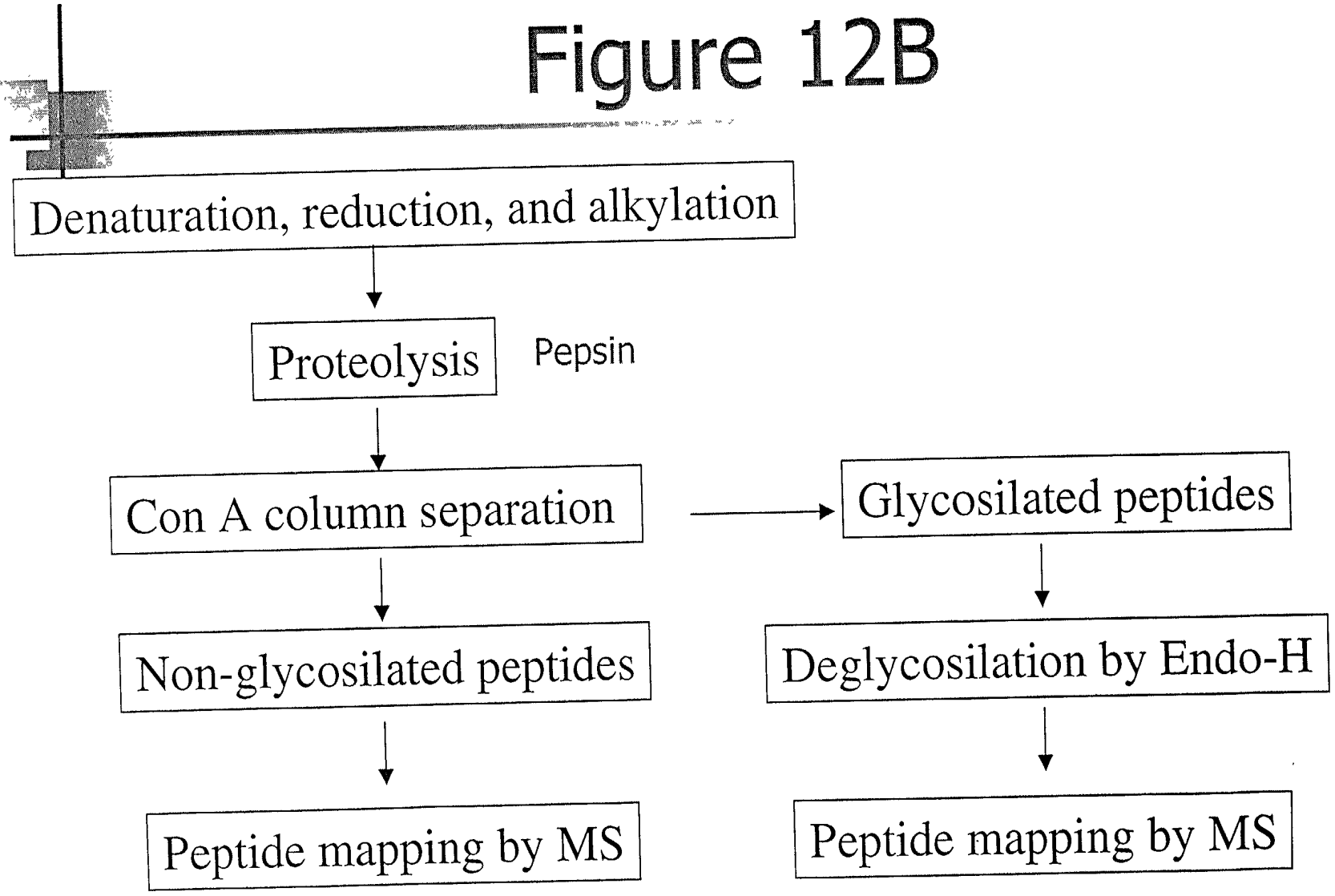

Denaturation, reduction, and alkylation
Proteolysis
Pepsin
Con A column separation
Glycosilated peptides
Non-glycosilated peptides
Deglycosilation by Endo-H
Peptide mapping by MS
Peptide mapping by MS

Figure 13A

QSEPELKLES VVIVSRHGVR APTKATQLMQ DVTPDAWPTW PVKLGELTPR GGELIAYLGH

YWRQRLVADG LLPKCGCPQS GQVAIIADVD ERTRKTGEAF AAGLAPDCAI TVHTQADTSS

PDPLFNPLKT GVCQLDNANV TDAILERAGG SIADFTGHYQ TAFRELERVL NFPQSNLCLK

REKQDESCSL TQALPSELKV SADCVSLTGA VSLASMLTEI FLLQQAQGMP EPGWGRITDS

HQWNTLLSLH NAQFDLLQRT PEVARSRATP LLDLIKTALT PHPPQKQAYG VTLPTSVLFI

AGHDTNLANL GGALEL**N**WTL PGQPDNTPPG GELVFERWRR LSD**N**SQWIQV SLVFQTLQQM

RDKTPLSLNT PPGEVKLTLA GCEERNAQGM CSLAGFTQIV NEARIPACSL

Figure 13B

QSEPELKLES VVIVSRHGVR APTKATQLMQ DVTPDAWPTW PVKLGELTPR GGELIAYLGH

YWRQRLVADG LLPKCGCPQS GQVAIIADVD ERTRKTGEAF AAGLAPDCAI TVHTQADTSS

PDPLFNPLKT GVCQLDNANV TDAILERAGG SIADFTGHYQ TAFRELERVL NFPQSNLCLK

REKQDESCSL TQALPSELKV SADCVSLTGA VSLASMLTEI FLLQQAQGMP EPGWGRITDS

HQWNTLLSLH NAQFDLLQRT PEVARSRATP LLDLIKTALT PHPPQKQAYG VTLPTSVLFI

AGHDTNLANL GGALEL**N**WTL PGQPDNTPPG GELVFERWRR LSD**N**SQWIQV SLVFQTLQQM

RDKTPLSL**N**T PPGEVKLTLA GCEERNAQGM CSLAGFTQIV NEARIPACSL

Figure 14

- Phytase in Pichia
  - There are three forms of phytase in Pichia. Each of them contains a single glyco-chain linked on amino acid #317, or #344, or #369.
- Phytase in S. Cerevisiae
  - There are three forms of phytase in S. Cerevisiae. The first form has two glyco-chain linked on amino acid #317 and #344. The second and third form carries a single glyco-chain that is linked on amino acid #317 or #344.